

IN THE SPECIFICATION:

Page 1: After the title, and before "Technical Field", please insert the following as the first paragraph:

This application is a U.S. National Phase Application under 35 USC 371 of International Application PCT/JP02/13003 filed December 12, 2002.

Please replace the paragraph at page 8, lines 12-17 with the following amended paragraph:

a light guide substrate which has one or more input ports, a plurality of output ports, one or more mirror receiving recesses that are formed in one surface of the light guide substrate, and light guides that conduct the light that is input into the one or more input ports to selected output ports among the plurality of output ports in accordance with the advance and retraction of ~~the~~ one or more mirrors with respect to the one or more mirror receiving recesses; and

Please replace the paragraph at page 10, lines 5-10 with the following amended paragraph:

a light guide substrate which has one or more input ports, a plurality of output ports, one or more mirror receiving recesses that are formed in one surface of the light guide substrate, and light guides that conduct the light that is input into the one or more input ports to selected output ports among the plurality of output ports in accordance with the advance and retraction of ~~the~~

one or more mirrors with respect to the one or more mirror receiving recesses; and

Please replace the paragraph at page 11, lines 5-10 with the following amended paragraph:

a light guide substrate which has one or more input ports, a plurality of output ports, one or more mirror receiving recesses that are formed in one surface of the light guide substrate, and light guides that conduct the light that is input into the one or more input ports to selected output ports among the plurality of output ports in accordance with the advance and retraction of the one or more mirrors with respect to ~~the~~ one or more mirror receiving recesses; and

Please replace the paragraph at pages 13, lines 17-19 to page 14, lines 1-3 with the following amended paragraph:

a light guide substrate which has one or more input ports, a plurality of output ports, one or more mirror receiving recesses that are formed in one surface of the light guide substrate, and light guides that conduct the light that is input into the one or more input ports to selected output ports among the plurality of output ports in accordance with the advance and retraction of the one or more mirrors with respect to ~~the~~ one or more mirror receiving recesses; and

Please replace the paragraph at pages 16, lines 13-18 with the following amended paragraph:

a light guide substrate which has one or more input ports, a plurality of output ports, one or more mirror receiving recesses that are formed in one surface of the light guide substrate, and light guides that conduct the light that is input into the one or more input ports to selected output ports among the plurality of output ports in accordance with the advance and retraction of the one or more mirrors with respect to ~~the~~ one or more mirror receiving recesses;

Please replace the paragraph at page 19, lines 16-19 to page 20, lines 1-2 with the following amended paragraph:

a light guide substrate which has one or more input ports, a plurality of output ports, one or more mirror receiving recesses that are formed in one surface of the light guide substrate, and light guides that conduct the light that is input into the one or more input ports to selected output ports among the plurality of output ports in accordance with the advance and retraction of the one or more mirrors with respect to ~~the~~ one or more mirror receiving recesses; and

Please replace the paragraph at page 21, lines 10-16 with the following amended paragraph:

a step of preparing a light guide substrate [i] which has one or more input ports, a plurality of output ports, one or more mirror receiving recesses that are formed in one surface of the light guide substrate, and light guides that conduct the light

that is input into the one or more input ports to selected output ports among the plurality of output ports in accordance with the advance and retraction of the one or more mirrors with respect to ~~the~~ one or more mirror receiving recesses, and [ii] on which first alignment marks are formed;

Please replace the paragraph at page 22, lines 12-17 with the following amended paragraph:

a step of preparing a light guide substrate which has one or more input ports, a plurality of output ports, one or more mirror receiving recesses that are formed in one surface of the light guide substrate, and light guides that conduct the light that is input into the one or more input ports to selected output ports among the plurality of output ports in accordance with the advance and retraction of ~~the~~ one or more mirrors with respect to the one or more mirror receiving recesses;

Please replace the paragraph at page 24, lines 1-5 with the following amended paragraph:

The twenty-eighth invention is any of the twenty-fifth through twenty-seventh inventions, which is characterized in that the actuators are constructed so that when absolutely no signals are supplied, the mirrors supported on these actuators return to specified positions that are farther from ~~the actuator substrate~~ on the first surface of ~~this substrate~~ the actuator substrate than the second positions, and

Please replace the paragraph at page 24, lines 11-16 with the following amended paragraph:

a step of preparing a light guide substrate which has one or more input ports, a plurality of output ports, one or more mirror receiving recesses that are formed in one surface of the light guide substrate, and light guides that conduct the light that is input into the one or more input ports to selected output ports among the plurality of output ports in accordance with the advance and retraction of ~~the~~ one or more mirrors with respect to the one or more mirror receiving recesses;

Please replace the paragraph at page 25, lines 8-11 with the following amended paragraph:

the actuators are constructed so that when absolutely no signals are supplied, the mirrors supported on these actuators return to specified positions that are farther from ~~the actuator substrate on the first surface of this substrate~~ the actuator substrate than the second positions, and

Please replace the paragraph at page 28, lines 12-18 with the following amended paragraph:

These ~~twenty-ninth~~ thirty-first and ~~thirtieth~~ thirty-second inventions make it possible to provide a light beam switching and adjustment device in which discrimination of the positional relationship between the insertion plates and the slits disposed in the light guide cores is easy. Furthermore, in addition to this, the ~~thirty-first~~ thirty-third invention makes it possible to provide a light beam switching and adjustment device in which

discrimination of the insertion positions of the insertion plates inside the slits is easy.

Please replace the paragraph at page 34, lines 5-20 with the following amended paragraph:

The light guides 25 are formed so that these light guides conduct the light that is input into the three input ports 21 to selected output ports in accordance with the advance (see Figure 2) and retraction (see Figure 3) of 3 x 3 individual mirrors 31 (described later) corresponding to the 3 x 3 individual grooves 24. In the present embodiment, the light guides 25 are formed in the form of a 3 x 3 matrix, and the grooves 24 are respectively formed at the 3 x 3 intersection points of this matrix. The number of 3 x 3 described above is merely an example; the present invention is not limited to this number. In cases where a construction with the form of a two-dimensional matrix is used, this number may be set in general terms at M x N (M and N are integers of 2 or greater) instead of 3 x 3. For example, a case in which this number is 100 x 100 is the same in principle. Of course, in the present invention, it is not always necessary to use a two-dimensional matrix-form construction. The respective ports 21, 22 and ~~33~~ 23 constitute the end portions of the light guides 25 appearing at the end surfaces of the light guide substrate 2. Furthermore, the light guides 25 are constructed from core layers, cladding layers and the like; the construction of these light guides 25 is universally known.

Please replace the paragraph at page 42, lines 15-20 to page 43, lines 1-10 with the following amended paragraph:

In electrical-circuit terms, the single actuator 32 that drives the single mirror 31 shown in Figures 6 through 9 may be viewed as a single capacitor (a capacitor formed by the first electrode part (substrate 4) and second electrode part (metal film 37 which constitutes the movable plate ~~21~~ 33). In Figure 10, the capacitors of the actuators 32 in m rows and n columns are respectively indicated as C_{mn} . For example, the capacitor of the actuator 32 at the upper left (row 1, column 1) in Figure 10 is indicated as C_{11} . When voltages are applied to the capacitors C_{mn} , an electrostatic force that causes mutual attraction is generated between the movable plates ~~21~~ 33 of the corresponding actuators and the substrate 4, so that the mirrors 31 assume a state in which these mirrors are drawn in toward the substrate 4 as shown in Figures 3 and 9. When the capacitors C_{mn} are discharged, the electrostatic force between the movable plates 21 of the corresponding actuators and the substrate 4 disappears, so that the mirrors 31 are caused by the spring force to assume a state in which the mirrors 31 protrude from the substrate 4 as shown in Figures 2 and 7. Specifically, the corresponding mirrors 31 can be moved by applying a voltage to the capacitors C_{mn} and discharging this voltage.

Please replace the paragraph at page 47, lines 8-15 with the following amended paragraph:

In the present embodiment, on the other hand, all of the switches ~~Mnma and Mnmb~~ Mmna and Mmnb can be switched ON independently of the outputs of the decoders DH and DV by adding the NOR gates NV1 through NV3 and NH1 through NH 3 and terminals V1 and H1 and wiring these parts as described above, so that the control terminals H1 and V1 are placed at a low level. In this case, if the terminals H1 and V1 are placed at a low level and the terminal C1 is placed at a high level, all of the capacitors Cmn are charged. As a result, a state is created in which all of the mirrors 31 are drawn in toward the substrate 4.

Please replace the paragraph at page 52, lines 14-21 to page 53, lines 1-6 with the following amended paragraph:

The six pads 42 respectively correspond to the terminals H1, V1, C1 and C2, the clamping voltage VC terminal and the ground terminal that are used in order to place all of the mirrors 31 in a state in which the mirrors are drawn in toward the substrate 4. Accordingly, these six terminals are respectively electrically connected to the lead terminals 45. Consequently, when the specified signals described above are supplied from the six lead terminals 45, all of the mirrors 31 can be placed in a state in which the mirrors are drawn in toward the substrate 4. In the state shown in Figure 12, since absolutely no signals are supplied, all of the mirrors 31 are in a state in which the mirrors protrude from the actuator substrate 4 as shown in Figure 12 (b). As will be described later, the lead terminals 45 are

used when the light guide substrate 2 and actuator substrate 4 are aligned. Following this alignment, the lead terminals 45 are cut along the end edge of the ~~actuator~~ relay substrate 4 5, so that only the root portions of the lead terminals 45 remain on the wiring patterns 44. Accordingly, the lead terminals 45 do not appear in Figure 1.

Please replace the paragraph at page 54, lines 14-20 with the following amended paragraph:

As a result of the electrical connections described above being made, the driving circuit shown in Figure 10 that is mounted on the actuator substrate 4 drives the actuators ~~31~~ 32 so that desired optical switching operations are performed when signals that cause these optical switching operations to be performed are respectively supplied to the ten pads 46, and so that all of the mirrors 31 are placed in a state in which the mirrors are drawn in toward the substrate 4 when specified signals are respectively supplied to the six conductive parts.

Please replace the paragraph at page 57, lines 15-19 to page 58, lines 1-22 with the following amended paragraph:

The conditions of this alignment are shown in Figure 14. Figure 14 is a schematic sectional view which shows (in model form) the conditions of the alignment of the actuator substrate 4 and the light guide substrate 2; this figure corresponds to Figures 2 and 3. This alignment is performed in a state in which all of the mirrors 31 are drawn in toward the substrate 4 as a result of the specified signals described above being supplied to

the lead terminals 45 in the assembly shown in Figure 12 from a voltage application circuit 51 via lead wires 52 as shown in Figure 13. Figure 13 shows diagrams which illustrate the conditions of voltage application to the assembly shown in Figure 12; Figure 13 (a) is a schematic plan view as seen from the +Z side, and Figure 13 (b) is an arrow view along line Y5-Y6 in Figure 13 (a). Since alignment is performed in a state in which all of the mirrors 31 are drawn in toward the substrate 4, even if the actuator substrate 4 is lowered downward in Figure 4 14 in a state in which the position of the actuator substrate 4 in the left-right direction in Figure 4 14 is shifted, the system will be regulated in a state in which the actuator substrate 4 contacts the spacer 3 before the mirrors 31 strike portions other than the grooves 24 in the light guide substrate 2 (this is also seen from Figure 3). In particular, this effect is ensured by the disposition of the spacer 3 so that this spacer 3 surrounds the region in which the mirrors 31 are distributed on the actuator substrate 4 as shown in Figure 11. As a result, a situation can be prevented in which the mirrors 31 collide with other locations and are damaged; therefore, the manufacturing yield is improved. Such a complete damage preventing effect that prevents damage to the mirrors 31 during this alignment is obtained both as a result of the fact that all of the mirrors 31 are in a state in which the mirrors are drawn in toward the substrate 4 during alignment, and as a result of the fact that the spacer 3 is interposed. However, even if only one of these two means is used, damage to the mirrors 31 is far less likely than in cases where neither of these means is used.

Please replace the paragraph at page 59, lines 1-15 with the following amended paragraph:

Since the number of terminals used in order to place all of the mirrors 31 in a state in which the mirrors are drawn in toward the substrate 4 is only six terminals (as was described above), the number of temporary lead terminals 45 required is also only six terminals; accordingly, the size of the relay substrate 5 can be reduced while maintaining the disposition pitch of the lead terminals 45 at a pitch that allows easy electrical wiring with respect to the voltage application circuit ~~21~~ 51. The size and cost of the light beam switching and adjustment device can therefore be reduced. For example, in cases where the circuit construction described above in which the NOR gates NV1 through NV3 and NH1 through NH3 and the terminals V1 and H1 are removed is employed, 16 lead terminals 45 must be lined up side by side in the example described above in which the number of mirrors 31 is 64 64. As a result, the relay substrate 5 must be made fairly large, so that an increase in the size and cost of the light beam switching and adjustment device is unavoidable. Furthermore, the pads 42 can generally be manufactured with a narrower pitch than the lead terminals 45.

Please replace the paragraph at page 59, lines 16-20 to page 60, lines 1-8 with the following amended paragraph:

Furthermore, the alignment of the actuator substrate 4 and light guide substrate 2 is performed while the alignment marks 26 and 39 respectively formed on the light guide substrate 2 and actuator substrate 4 are observed by means of infrared light.

For example, the alignment marks 26 and 39 are observed through the actuator substrate 4 using an infrared microscope, and the movement of the actuator substrate 4 in the lateral direction to a position where the marks 26 and 39 are completely superimposed, and the movement of the actuator substrate 4 toward the light guide substrate 2, are simultaneously or alternately repeated so that the alignment marks 26 and ~~29~~ 39 are aligned. Then, the actuator substrate 4 is caused to contact the spacer 3, and the actuator substrate 4 is joined to the spacer 3 by means of a bonding agent, etc. Thus, since this alignment is performed using the alignment marks 26 and ~~29~~ 39, the alignment is easy, and this alignment can be performed with good precision.

Please replace the paragraph at page 62, lines 1-3 with the following amended paragraph:

Subsequently, all of the lead terminals 45 are cut along the end edge of the ~~actuator~~ substrate ~~4~~ 5 using a cutting tool or the like. The reason for this is that it is no longer necessary to supply signals from the voltage application circuit 51.

Please replace the paragraph at page 66, lines 1-11 with the following amended paragraph:

Ordinarily, in a light beam switching and adjustment device, the insertion plate driving wiring is formed as metal wiring, and this metal wiring presents an obstacle to microscopic observation of the insertion positions (insertion depths) of the insertion plates inside the slits. In particular, observation is extremely difficult in cases where the metal wiring is disposed in the

vicinity of the slits and insertion plates. Accordingly, in the light beam switching and adjustment device of the present invention, the system is devised with the insertion plate driving wiring 110 disposed around the peripheries of the insertion plates 103 instead of in the vicinity of the insertion plates 103, so that observation of the in-plane positional relationship between the slits 102 and insertion plates 103 in the plane parallel to the plane of the core ~~holding~~ supporting substrate 112 is facilitated.